HAND GESTURE CONTROLLED CAR

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ABSTRACT –

In this paper, a real time vision system is proposed to monitor the number of hand fingers and based on the number of fingers respective action is performed by mobile robot. This system is built on raspberry pi 3b+ with raspberry pi camera module. The Raspberry pi is used as controller and camera module is used to capture the real time videos. The Raspberry pi is programmed with Python programming language supported by Open Source Computer Vision (Open CV) library.

The primary goal of hand gesture recognition research is to create a system which can identify specific hand gestures and use them to convey information or for device control. Gestures are physical movements of a person's finger or hand. In this paper, we are using number of fingers as a gesture and recognized gestures are used to control the motion of mobile robot in real time. The motion of robot with different directions: Forward, backward, Right, Left.

KEYWORD'S: Raspberry pi, Raspberry pi camera module, Python, Open CV, Robot.

INTRODUCTION

Hand gesture recognition has evolved hugely in recent few years because of its ability to communicate with machine efficiently. Gestures include movement of the hands, face, or other part of body. Physical nonverbal communication such as purely expressive displays or displays of joint attention differs from gestures, which communicate specific message. In gesture recognition technology, a camera reads the movements of the human body and communicates the data to computer that uses the gestures as input to control devices or application. We need to know, how human use gestures to

Communicate with and command other people are explored. People frequently use gestures to interact. They are used for pointing to a person, to get his attention and convey information about spatial and temporal characteristics.

SYSTEM ARCHITECTURE

Capture the frames:

The System has 5MP raspberry pi camera module which is able to capture 1080p, 720p, 480p video and still image. The camera has resolution of 2592*1994. The Pi's camera module is capable of 80fps in later firmware. The Raspberry Pi could do 90 frames/second (fps) for high-speed photography using Raspberry Pi camera module. The input to the system is frames or the sequence of frames which is captured by the camera. The frames are captured with contrast background and our region of interest is (ROI) hand region. The captured frames are converted into grayscale image to find the region of interest.

Blur Frame

The image is blurred to reduce the noise and to reduce details. Blur frame is necessary process for frame enhancement and for getting good results. In Image processing Gaussian blur is the result of blurring an image by Gaussian function.

The Gaussian blur is a type of image blurring filter that uses a Gaussian function for calculating the transformation to apply to each pixel in the image. The formula of a Gaussian function in one dimension is

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

In two dimensions, it is the product of two such Gaussian functions, one in each dimension

$$G(x, y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Frame Segmentation

Frame segmentation is a background /foreground segregation process. If features of the pixel match with the background model, it is classified as background. Otherwise, it is a foreground (object) pixel.

There are various types of frame segmentation-
1) Thresholding method.
2) Edge detection based techniques.
3) Region based techniques.
4) Clustering based techniques.
5) Watershed based techniques.

In this system we are using thresholding method.
Thresholding method:
Thresholding is the simplest method of segmenting image. From Grayscale image, thresholding can be used to create binary images. An image frame is taken as input through the raspberry pi camera module. Binary thresholding is done on this image for recognition of the hand region. Initially minimum threshold value is set to a certain constant. This method simply replace each pixel in an image with a black pixel if the image intensity is less than some fixed constant intensity or a white pixel if the image intensity is greater than that constant intensity.

## Draw Contour and Convex Hull

Contours

After thresholding an image frame, contour is determined and drawn on the thresholded white blob. Drawing contour is the main problem in computer vision task. Number of contours generated will be many due to noise. So threshold value is incremented. Scan the frame from left to right and from top to bottom to find first contour pixel marked; then scan frame clockwise until the next pixel value is equal to 1.

Convex Hull

A convex Hull is drawn around the generated contour points. Convexity defects is used to generate the list of defects in the convex hull. In this system, the convex points are considered to be the tips of fingers. The red dots are the defect points appeared in every valley. And depending upon the number of convex points the number of fingers are calculated.

BLOCK DIAGRAM
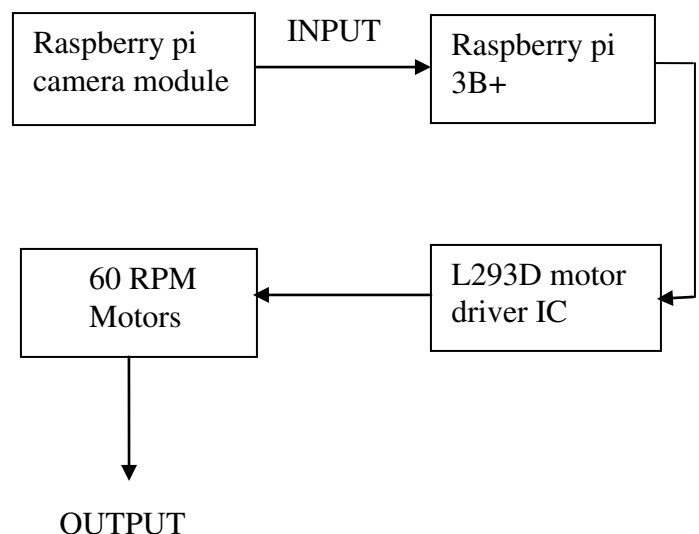
Software Required
Raspbian OS, Python and Open CV

Hardware Required

Platform
The mobile robot has a platform which is made up of foam. Foam is lightweight solid material which is widely used to make mobile robots. On the platform components are placed. i,e. Raspberry pi 3b+, l293d motor driver IC, camera module, battery.
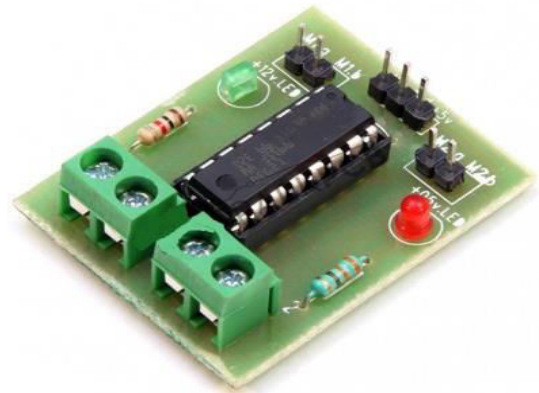
Raspberry pi 3b+
Raspberry pi is a series of small single board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. In this system, Raspberry pi is used as controller. It controls the robot. It is mounted on platform. It is powered up with the help of battery.

Motor Driver IC
Motor Driver IC are used to control the DC motors. L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16 pins which are used to control a set of two DC motors instantaneously in any direction. It means, by

using a L293D we can control two DC motors. As well, this IC can drive small and big motors.

DC Motors
The DC motors are used to run the robot, this system has two 60 rpm DC motors and 1 caster wheel. These motors are controlled with help of motor driver IC.
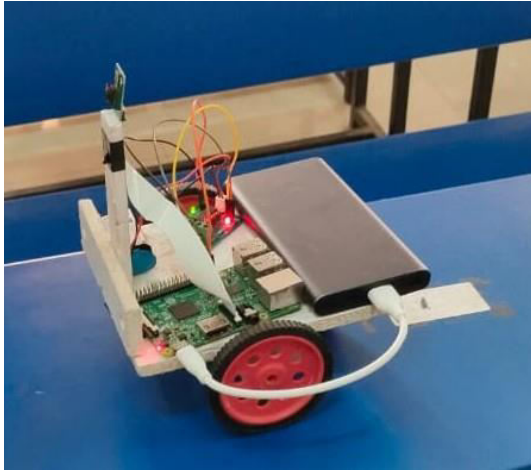

Raspberry pi Camera Module
The Raspberry Pi Camera Module is an official product from the Raspberry Pi Foundation. It is of 5 mega pixel. It captures the frames or sequence of frames.
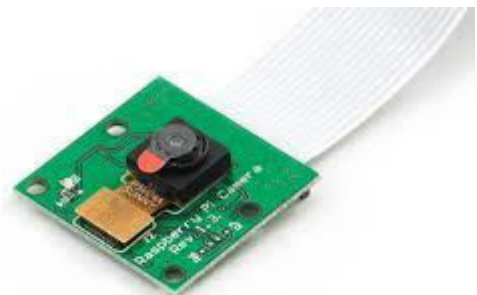
MODEL

FUTURE ENHANCEMENT

1. By integrating our system with voice recognition system we can embed it in ROBOTS.
2. We are also able to handle dynamic image processing and event handling accordingly.

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